

Strength of Light in the Object encreased in Proportion to the Square of the Length.

At the End of the Treatise is subjoined a Letter from the Reverend Father *Melchior à Briga*, &c. to the Author, giving an Account of some former Attempts to discover the Revolution of this Planet round its Axis, by Mr. *Cassini*, *De la Hire*, &c. consisting chiefly of an Extract of a Letter from Mr. *Cassini* to Mr. *Petit*, printed in the *Journal des Sçavans*, 1667, Tom. ii. Edit. *Amst.* The 2d and 3d Figures which are referred to in this Letter, are inverted by the Engraver, who copied them from the Original.

VII. *Observations on a Treatise wrote by Mons.*

Helvetius of Paris, designed to prove that the Lungs do not divide and expand the Blood, but that on the contrary, they cool and condense it.
By F. Nicholls, M. B. Prael. Anat. Oxon & F. R. S.

THE Matter in Question between the Author and Signior *Michellotti* is, whether the Lungs cool and condense the Blood, according to the Opinion of the Antients, or whether they mix, attenuate, and of Consequence expand it, according to the System of Dr. *Pitcairn*.

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The Author, in order to support the Opinion of the Antients, brings several Arguments to confute the System of Dr. *Pitcairn*: The most considerable of which (and which indeed he makes his *Argumentum crucis*) is, that the right Auricle and Ventricle being considerably larger than the left Auricle and Ventricle, and the pulmonary Artery having a larger Capacity than all the pulmonary Veins taken together, the Blood must evidently occupy a greater Space before than after its Passage thro' the Lungs; and because the Difference in the Capacity of these Vessels cannot be ballanced by any Increase of the Velocity, he concludes, that the Blood is not attenuated and expanded, but must be condensed in its Passage through the Lungs. And this the Author conceives is done by the Air, which (as a Fluid relatively cold) must cool and condense the Blood, to which it is so nearly applied in the Action of Inspiration.

Had the Author of this Treatise been contented with supporting the Opinion of the Antients, without endeavouring to subvert the System of Dr. *Pitcairn*, he would probably have found many Advocates for his Doctrine, and few Opposers.

That the Blood is cooled by the Action of Inspiration, is a Matter of which I believe few Physicians doubt, when they consider that in Inflammations of the Lungs, nothing is more earnestly desired than the breathing cool and fresh Air, nor does any thing more evidently conduce to the Cure of these and other Inflammatory Dispositions, than the Use of fresh Air. But that this is the sole Use of breathing, or that this cooling Power can over-balance the Expansion from the Action of Expiration, is what I can no ways conceive.

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If we consider the State of the Blood at its Return to the Heart, and how careful Nature has been, not to use this Blood for the Nourishment of the Lungs before it has passed through the pulmonary Vein and Artery (though it would in that Case have been as effectually cooled in the Bronchial Arteries as in the pulmonary Vessels) we are naturally led to believe, that it is some other Quality which has rendred it improper for Nourishment, and which is to be destroyed by the Action of the Lungs.

I have before allowed, that it seems almost evident that the Blood is cooled, and of Consequence condensed in the Action of Inspiration; but for the Reason mentioned, and from considering the Structure of the Parts subservient to breathing, it seems equally true, that the Blood is mixed, attenuated, and consequently re-expanded in the Action of Expiration. I shall now consider whether the Action of Inspiration so far over-balances the Action of Expiration, as to condense the Blood into a less Bulk than it had before its Passage through the Lungs.

The accurate *Santorini* of *Venice*, in the 8th Chapter and 3d Section of his Observations, has carefully examined the Fact as stated by Mons. *Helvetius*; and finding it true in that one Subject, as to the Auriacles and pulmonary Vessels, but false as to the Ventricles, he proceeds to prove that this Difference in the Capacity of the pulmonary Vessels, could not be designed on Account of the Blood's being condensed in its Passage through the Lungs; because, if so, the right Ventricle ought to have been larger than the left Ventricle; and the pulmonary Artery ought, not only to have been larger than the pulmonary Veins, but

but it ought likewise to have been larger than, or at least equal to, the two *Vene Cavae*; whereas in his Subject, the two *Vene Cavae* were to the pulmonary Artery, as 228 to 188.

In the mean time, he recommends the repeating the Enquiry to other Anatomists, as doubting whether the Fact is constantly so in healthy Subjects. *Ut cæteri diligentiores Anatomici disquirant utrum ea firma & perpetua sint? an in corporibus integris.*

As such an Enquiry may be of Consequence, not only in settling the Point in Question, but in explaining other Parts of the Animal Oeconomy, I doubt not but it will be agreeable to the Society; and the rather, because the Subjects from which I have taken the several Calculations, are here produced before the Society, and submitted to a Re-examination, if desired.

The Measure which I have here used is the 113th Part of an Inch.

I have taken the Triple of the Diameter for the Periphery, and computed the *Area* by multiplying the nearest whole Number to $\frac{1}{4}$ of the Diameter into the Periphery. Though this Method is not sufficiently exact to shew the real Contents of Circles, yet as my Design here, was only to find nearly the relative Contents of the several Vessels, I have chose to avoid embarrassing the Sums with Fractions.

The first Heart is of an Adult in which

The *Diam. Per. & Areas* are

Of the Vena Cava descendens	79	237	4740
Pulmonary Artery	115	345	10005
Superior left pulm. Vein	69	207	3519
Inferior left pulm. Vein	73	219	3942
Superior right pulm. Vein	49	147	1764
Middle right pulm. Vein	40	120	1200
Inferior right pulm. Vein	57	171	2052
Aorta	110	330	8910

The ascending Cava being tied above the Diaphragm, could not be measured in this Subject.

As Mons. *Helvetius* no ways mentions the Disease of which the Subject died from whom he took his Observation, so I cannot say how proper it was for such an Examination ; but it is evident, his Observation does not tally with the Calculations made from this first Heart ; where the pulmonary Artery is to the Sum of all the pulmonary Veins as 10005 to 12477. And yet this Subject (besides a cancerated Ovary, and a Putrefaction of the right Kidney from the Ureter's being compressed) had her Lungs full of small Tubercles, and the Glands lying between the great Divisions of the *Trachea* almost petrified by atheromatous Concretions : By all which it is highly probable, that the Passage of the Blood through the Lungs was very much impeded, and of Consequence, the pulmonary Artery much dilated beyond its natural Capacity.

And this I am the rather induced to believe from examining the second Heart, which is of a Child nearly twelve Months old. As to its Death, I can say nothing

nothing more, than that its Lungs appeared perfectly sound, and of a pale clear Colour ; and therefore the more proper for an Examination of this Kind.

In this second Heart the *Diam. Per. & Areas* are, Of the Aorta above the Coronaries 43 129 1419

Pulmonary Artery 43 129 1419

Superior left pulm. Vein 29 87 609

Inferior left pulm. Vein

Superior right pulm. Vein 26 78 507 } 2088

Middle right pulm. Vein 17 51 204 } 204

Inferior right pulm. Vein 32 96 768 }

We may here observe that the Aorta, after giving off the Coronary Vessels, is equal to the pulmonary Artery. As to the Proportion between the pulmonary Artery and Veins, the Artery in this Subject is to the Sum of all the Veins here measured, as 1419 to 2088, and yet the lower left pulmonary Vein is here omitted, as being tied too close to admit of being measured. But if we suppose the inferior left pulmonary Vein to be to the superior left pulmonary Vein in the same Proportion as in the first Heart, we shall then find its Diameter nearly 31, and its Area at least 700, which will make the pulmonary Artery in this Heart, to the Sum of all the pulmonary Veins as 1419 to 2788 ; and in that Case, the left pulmonary Veins will be to the right pulmonary Veins, but as 1309 to 1479.

The 3d Heart is of an Abortive nearly of 5 Months : By its Appearance, I judged it suffocated by too much Blood. In this Subject the *Diam. Per. Areas* are,

Of the	Vena Cava descendens	14	42	197	629
	Vena Cava ascendens	24	72	432	
	Aorta above the Coronaries	16	48	192	
	Pulmonary Artery	20	60	300	
	Canalis Arteriosus	12	36	108	
	Right pulmonary Branch	11	33	99	198
	Left pulmonary Branch	11	33	99	
	Superior left pulm. Vein	11	33	99	
	Inferior left pulm. Vein	9	27	54	294
	Superior right pulm. Vein	7	21	42	
	Middle right pulm. Vein	11	33	99	

The inferior right pulmonary Vein is here cut too close, and otherways injured, so that its Area cannot be measured. Nevertheless we find the remaining pulmonary Veins to the pulmonary Branches of the pulmonary Artery, as 294 to 198.

We may here observe a remarkable Difference between the Capacities of the two *Venæ Cavae* taken together, and the pulmonary Artery ; the two *Cavae* being more than Double the pulmonary Artery, and the pulmonary Artery still one Third larger than the Aorta. As this Difference could not arise in this Case from the Blood's being condensed by the inspired Air, so it seems a Proof, that had the Fact been true, as stated by Mons. *Helvetius*, it had nevertheless been an insufficient Demonstration of his System.